Two patients with severely displaced maxillary canines respond differently to treatment

Case JA: Bilaterally displaced maxillary canines complicate a nonextraction approach; and Case EG: A severely displaced maxillary canine creates a number of extraction options

David L. Turpin, DDS, MSD; Heather Woloshyn, DMD, MSD

The patient with a severely displaced maxillary canine continues to challenge the orthodontic specialist. When the two patients in the following case reports presented, their problems seemed similar: each had a palatally displaced canine. However, unique clinical problems were soon diagnosed that led to the development of different treatment approaches. These differences are worth discussing, especially in light of newly published studies.[1-5]

In planning treatment for these two patients, the following questions are worth considering.

1. *Is it common for other dental anomalies (small lateral incisors, missing teeth) to occur more frequently in patients with palatally displaced canines?*
2. *Following surgical exposure of palatally displaced maxillary canines, how significant are the risks of tooth movement with regard to periodontal health, vitality, and retention?*
3. *Are new or improved surgical procedures becoming available to bring severely impacted teeth into alignment?*
4. *When planning ahead to replace a missing premolar with an endosseous implant, is it better to retain the primary molar as long as possible or extract it during treatment?*
5. *How stable is the closure of a maxillary median diastema years after a reasonable period of retention?*

Case Report JA

This female patient initially sought orthodontic treatment at the age of 13 years 1 month because her "front teeth were too far apart." She had a significant maxillary median diastema, undersized lateral incisors, and retained primary canines. All remaining permanent teeth, with the exception of third molars, were in the final stage of erupting into a Class I dental relationship.

Radiographic examination revealed the presence of bilaterally displaced maxillary canines. The right canine appeared to be at least 6 mm above the crestal bone, enclosed in an enlarged follicle. The left canine appeared to be rotated and positioned slightly more inferior at the level of the crestal bone. The roots of both pri-

Case Report JA
Figure 1A-B
Pretreatment facial photos at 13 years 1 month.

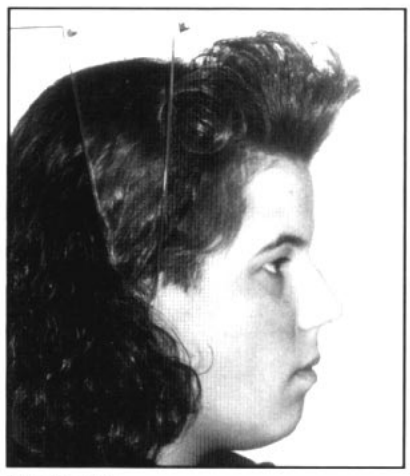

Figure 1A

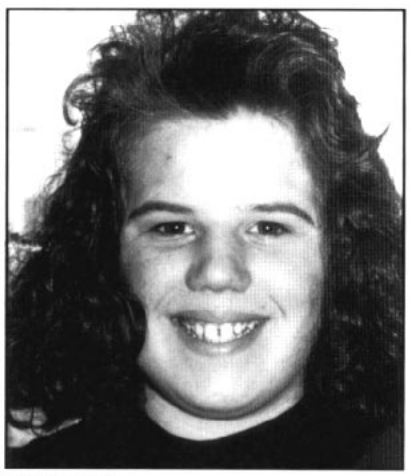

Figure 1B

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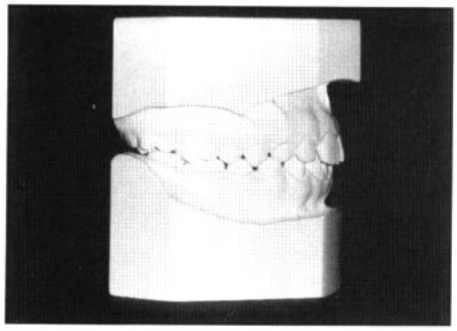

Figure 2A

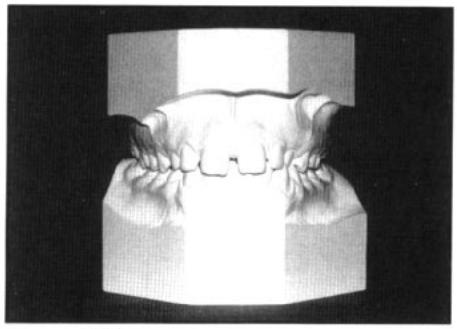

Figure 2B

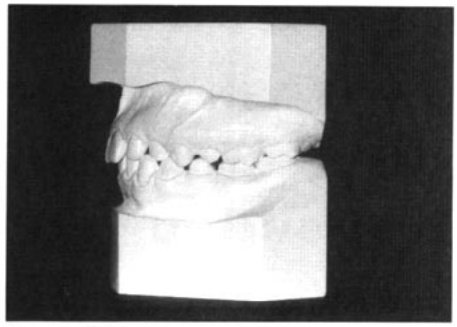

Figure 2C

Case JA
Figure 2A-E
Pretreatment study casts.

Figure 3
Pretreatment cephalometric tracing.

Figure 4
Note the bilaterally displaced maxillary canines in this panoramic radiograph at 13 years 1 month.

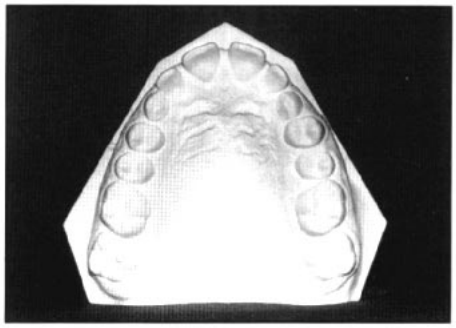

Figure 2D

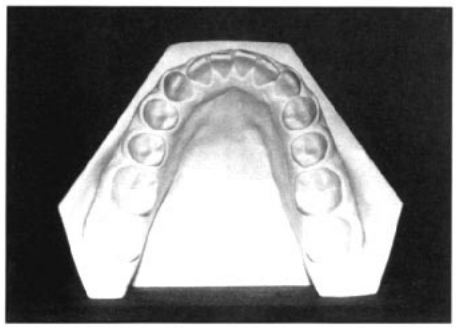

Figure 2E

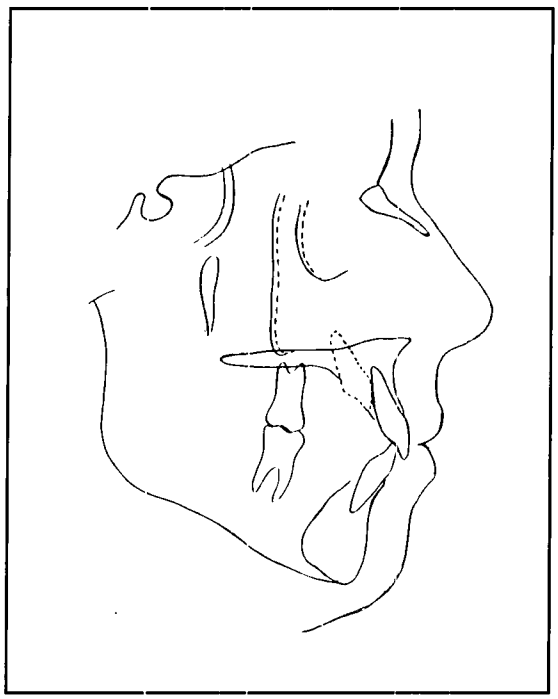

Figure 3

Figure 4

mary canines appeared to be resorbing.

The patient's medical history was noncontributory. Her tonsils and adenoids had been removed when she was 8 years old, and she had a digit sucking habit until she was 10. Her father had been under the care of a specialist for temporomandibular disorder and expressed concern that his daughter had recently experienced episodes of clicking and popping in her TM joints. She was postpubertal at the time of examination and little growth was expected.

Examination of study casts revealed a Class I occlusion characterized by generalized spacing and a moderately deep overbite. The maxillary median diastema was pronounced and there appeared to be a mild dental asymmetry. There was a bony prominence palatal to the maxillary right canine area indicating a medial location of the impacted tooth on that

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side. On the left side, the canine prominence was more visible on the labial aspect of the alveolus, indicating a different location for the left canine.

Cephalometric analysis revealed relatively normal dental and skeletal relationships, but with a tendency for a convex profile with protrusion of both dental arches. The mandible was slightly retrognathic which was probably responsible for the mandibular dental protrusion.

Treatment options

Because of generalized spacing in the presence of acceptable skeletal and facial relationships, a nonextraction approach to treatment seemed ideal. This would require surgical exposure of both maxillary displaced canines and rather lengthy orthodontic therapy to move them into alignment. The advantage of this approach was the possibility of improving both function and esthetics with a full compliment of teeth; dental implants or bridges would not be needed if the impacted teeth could be aligned successfully. The disadvantages of this approach included the risk of long treatment and possible failure. Either one of the displaced canines could become ankylosed, lose vitality, or create problems—such as root resorption, loss of vitality, or loss of hard or soft tissue—for adjacent teeth. Long-term stability of the posttreatment result was also a major concern.

While alternative plans for treatment seemed attractive to the patient initially, they lost appeal when long-term considerations were addressed.

Fixed bridges have few advantages for a patient at this young age. First, orthodontic treatment would still be necessary following extraction of the displaced canines. Then there is the need to temporarily replace the missing canines until fabrication of the final prosthesis. There is also the probability that any fixed prosthetic device will require repair or replacement periodically throughout the patient's lifetime.

The use of endosseous implants is another approach that has a few disadvantages for a patient this age. Orthodontic treatment would still be necessary to close anterior spaces and reduce the overbite. Functional as well as esthetic needs when replacing canines would require ideal conditions for the use of this alternative. Because of these demands, cost might also become a factor affecting the patient's decision.

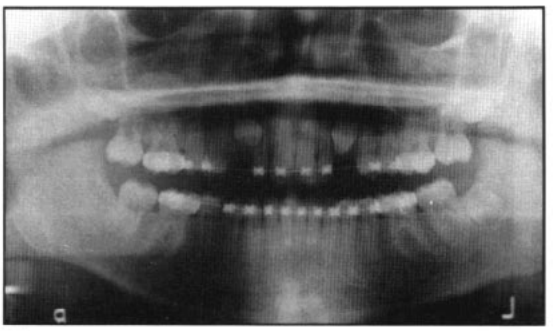

Figure 5

Figure 6A

Figure 6B

Figure 5
Progress radiograph at 13 years 6 months revealed the need for a second surgical exposure of the palatally impacted canines.

Figure 6A-B
Although the patient's left canine seemed to be in a more favorable position, the right canine did not appear to be moving.

A final alternative, extraction of the impacted canines followed by maxillary space closure, had its own set of problems due to the presence of generalized spacing in a Class I occlusion. Treatment would be long and retention to prevent space opening would be difficult. The undersized maxillary laterals could be enlarged, which might help to improve esthetics as well as stability.

Treatment plan

A nonextraction approach was initiated and an oral surgeon exposed both maxillary canines with minimal soft tissue removal. The primary canines would be extracted, fixed appliances would be used on all permanent teeth to close spaces and reduce the overbite. When stabilized, the maxillary dentition would be used to bring the surgically exposed canines into alignment. Extraoral traction would be used as needed to reduce facial convexity.

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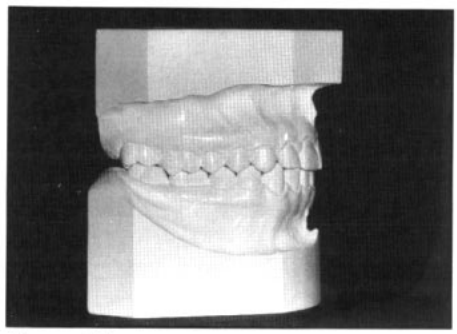

Figure 7A

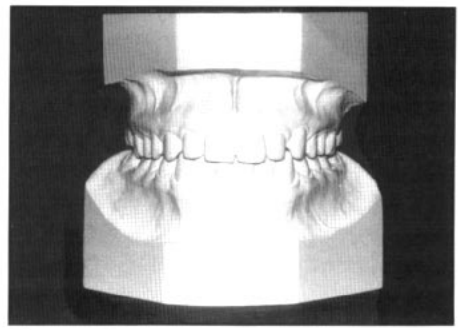

Figure 7B

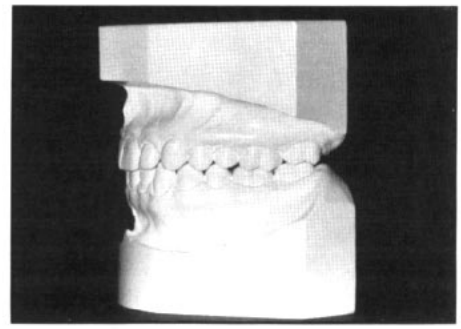

Figure 7C

Case JA
Figure 7A-E
Posttreatment study casts.

Figure 8
Posttreatment panoramic radiograph.

Figure 9
Superimposed pretreatment and posttreatment tracings at 13 years 1 month and 16 years 4 months. Note the minimal mandibular growth.

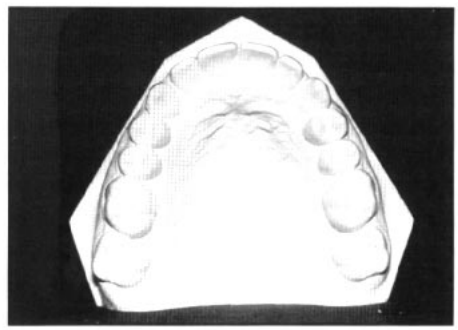

Figure 7D

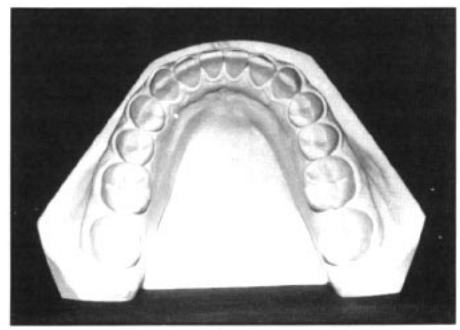

Figure 7E

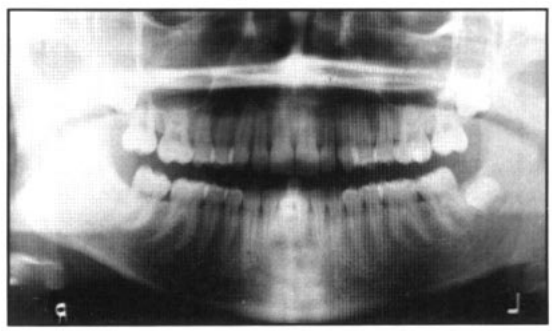

Figure 8

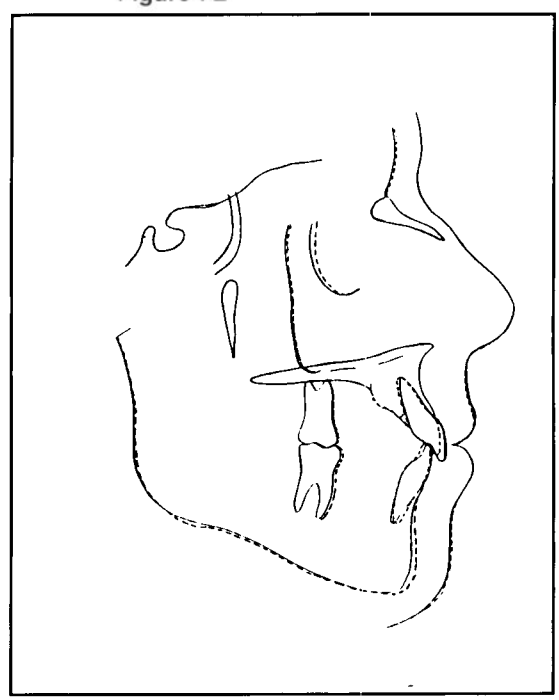

Figure 9

As a part of informed consent the patient was told that a nonextraction approach might not be successful, and that it could be necessary to extract one or both of the impacted canines. Furthermore, the process of surgically exposing the displaced canines and mechanically bringing them into occlusion could result in the loss of tooth vitality, altered soft tissue attachments, bone loss as well as mobility and retention problems.

Active treatment would take 24-28 months following surgical exposure of the canines.

Treatment progress

Immediately following surgical exposure of the canines and extraction of the primary teeth the oral surgeon reported: "Due to the location of #6 (the right canine), I was unable to get adequate access. The tooth was not ankylosed but because of its long root it could not be moved into a more favorable position to help its eruption. However, I think it has a good chance to erupt when the lateral incisor root is moved away from it. Tooth #11 (the left canine) has a much better chance."

One month later fixed appliances were placed on the patient's remaining teeth and active treatment was initiated. The surgically exposed canines were not yet visible upon intraoral examination. Active treatment continued as planned over the next 6 to 8 months with the only concern being eruption of the

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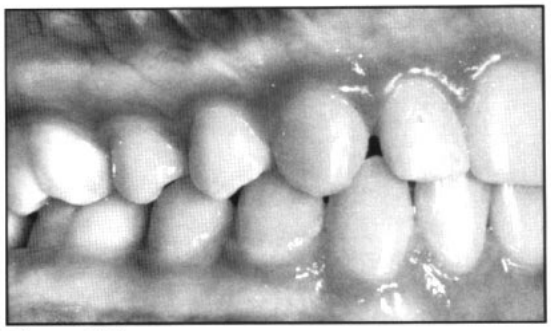

Figure 10A

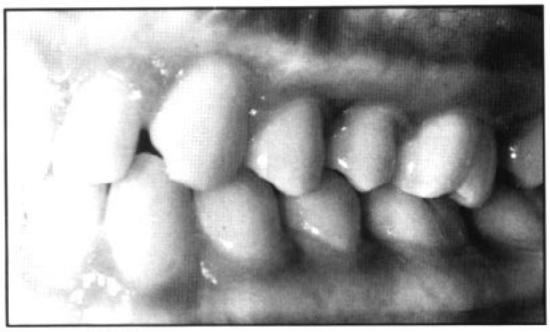

Figure 10B

Figure 10 A-B Posttreatment intraoral photos at 16 years 4 months.

Figure 11A-B Posttreatment facial photos at 16 years 4 months.

displaced canines. Although one tooth seemed to have moved into a more favorable location, the oral surgeon was asked to provide additional exposure approximately 1 year into treatment.

According to his postsurgical notes: "Additional bone and soft tissue were removed this time. Tooth #6 was redirected and a celluloid crown placed to help keep the channel open for passive eruption. Tooth #11 was redirected and exposed into the oral cavity." Within 3 months of this procedure it was possible to bond a button onto the left canine to help control its eruption into the arch. Another 6 months passed before it was possible to bond to the other canine.

Gradually, the maxillary canines were aligned and remaining spaces closed. A progress panoramic radiograph was taken prior to the completion of treatment to examine root parallelism. In the finishing stage of treatment it was decided to leave a small space distal to each maxillary lateral incisor so that following active treatment they could be enlarged for improved esthetics.

Results

Active treatment required an additional 9 months over the original estimate, primarily due to the unpredictable eruption of the maxillary canines following surgical exposure. In fact, it is unusual to need a second surgical procedure as was required in this case. With this one exception, all treatment objectives were attained. A Class I dental relationship was maintained and the occlusion improved as all spaces were closed and the overbite reduced. Both maxillary canines appear to be in near ideal position with good esthetics and function. The patient has canine disclusion during lateral excursive movements with no balancing interferences. Bone levels are normal and soft tissues appear healthy.

Figure 11A

Figure 11B

Cephalometric analysis shows a small amount of mandibular growth occurred during treatment. It is interesting to note that extra-oral traction was not needed to maintain the Class I relationship.

The patient wore removable retainers full-time for the first 6 months following the completion of active therapy and then retainers only at night. Future plans include bonding a lingual retainer to hold the maxillary median diastema closed until the lateral incisors can be enlarged.

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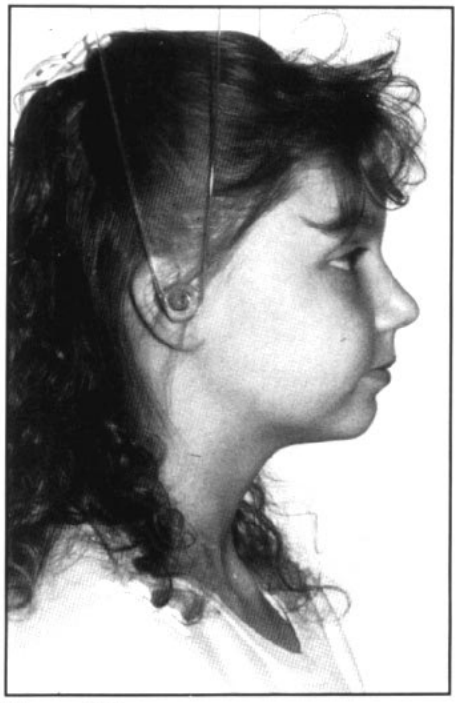

Figure 12A

Figure 12B

Figure 12C

Case Report EG
Figure 12A-B
Pretreatment facial photos at 10 years 5 months.

Case Report EG

This female patient initially presented for examination at the age of 9 years 6 months because her pedodontist realized she was missing a second premolar. She had a Class II malocclusion, subdivision right, with generalized crowding. The overbite was deep and the dental asymmetry noticeable. The patient's pattern of eruption was slow with 13 primary teeth still remaining.

Radiographic examination revealed a congenitally missing mandibular right second premolar as well as a severely displaced maxillary left canine. One remaining primary lateral incisor and four primary canines were extracted and the patient was recalled periodically for observation.

Less than a year later comprehensive diagnostic records were gathered. The patient had a history of digit sucking until the age of 2. All past medical history was essentially noncontributory. She was still immature and continued growth was expected. The examination of study casts revealed a Class II molar relationship on the left side combined with a Class I on the right. The dental asymmetry seemed to be present throughout the entire occlusal relationship. No significant functional shift was identified. Eight primary molars were in place and showed no signs of exfoliation. Incisor alignment was improving with eruption, but maxillary arch length deficiency measured 3 mm.

Cephalometric analysis revealed a slightly retrusive mandible (SNB=76°, ANB = 4°) but relatively good skeletal and dental relationships overall. Facial balance was good with lip competence and a slightly convex profile due to the mild mandibular deficiency.

Treatment options

Because the patient was 10 years 5 months old and had a slow pattern of dental development, active treatment was delayed for another one to two years. The maxillary primary first molars were extracted to speed the eruption of premolars and the patient was placed on recall.

At the age of 12 years, 6 months study casts and another panoramic radiograph were gathered for a final decision and plan of treatment. Only three primary molars remained and one of those had no permanent successor. The Class II molar relationship on the left side was more prominent than ever, combined with a lack of space for the canine on the same side. Other remaining permanent teeth were erupting as well as could be expected.

Nonextraction treatment was ruled out at this time. The maxillary left displaced canine was severely impacted and its development was forcing the crown into close proximity with the root of the lateral incisor, yet it was still horizontally displaced in the palate. Extracting the displaced canine and substituting the first premolar would help alleviate the shortage of space in that quadrant. Space would be closed

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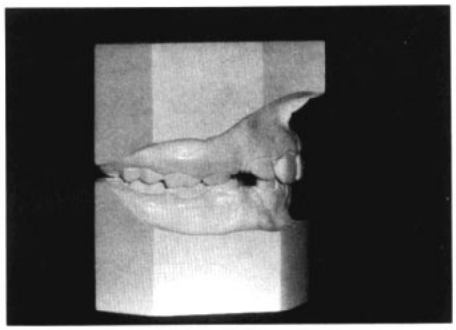

Figure 13A

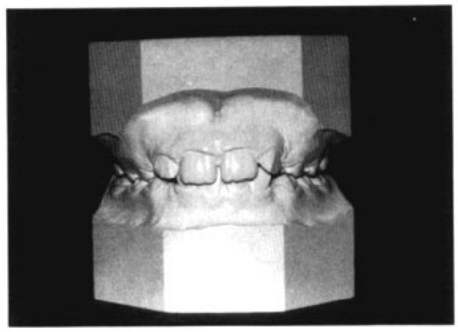

Figure 13B

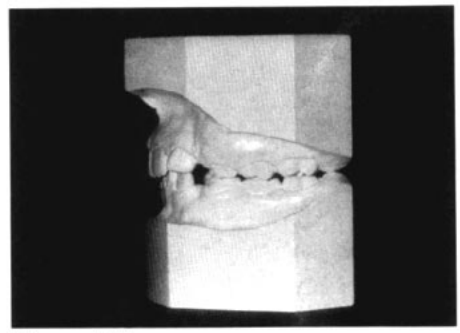

Figure 13C

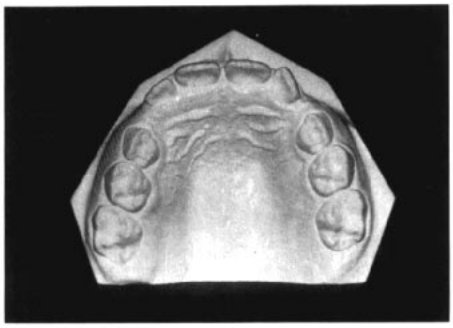

Figure 13D

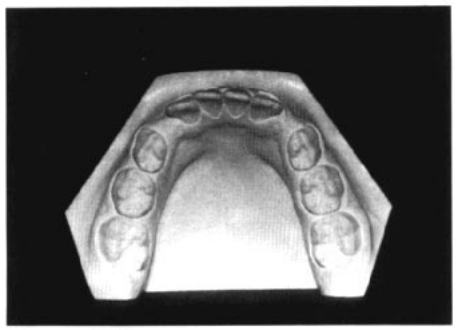

Figure 13E

Figure 13A-E
Pretreatment study casts.

Figure 14

Figure 14
Panoramic radiograph showing a severely displaced maxillary left canine and a congenitally missing mandibular second premolar.

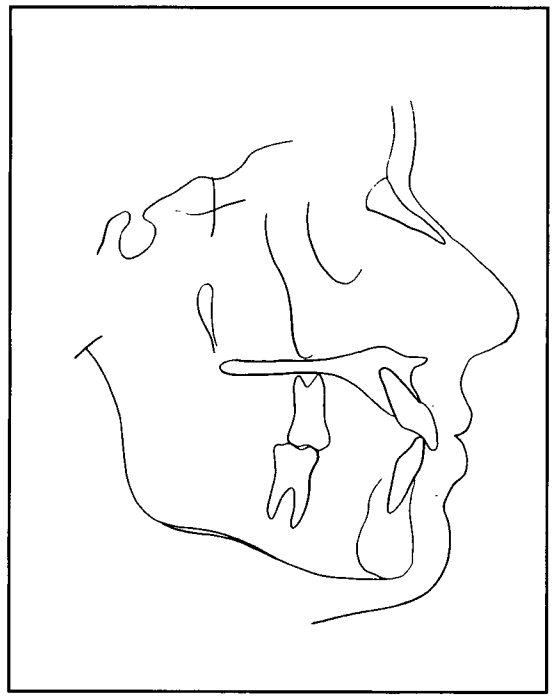

Figure 15
Pretreatment cephalometric tracing.

from both the anterior and posterior, leaving the molar relationship Class II on the left.

The primary second molar on the right side would be retained in the mandibular arch as long as possible. Of course, the additional space required for the primary molar was a disadvantage, but the roots appeared healthy and it was felt the tooth might be functional for as long as 10 years. If the missing premolar were to be replaced in the future, problems with lengthy retention had to be considered.

The extraction of permanent teeth in the remaining three quadrants was rejected primarily because of the absence of crowding or protrusion. The patient had an excellent skeletal relationship and was expected to have adequate mandibular growth.

Following the extraction of the displaced canine, the initiation of appliance therapy was delayed another 4 months while remaining premolars erupted.

Treatment progress

Fixed appliances were initially placed on all maxillary teeth to achieve alignment and space closure. Appliances were placed in the mandibular arch 8 months later to help with overbite reduction and symmetry. Intermaxillary elastics and extraoral headgear were not required. Treatment was fairly uneventful and all fixed appliances were removed after 20 months of active therapy.

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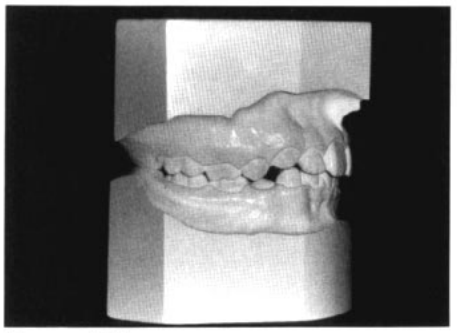

Figure 16A

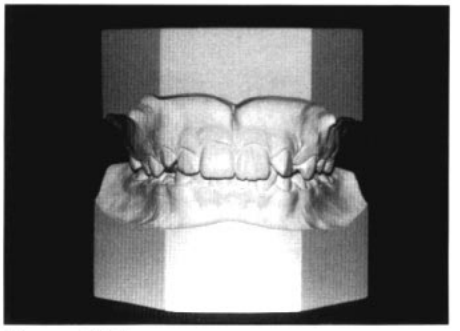

Figure 16B

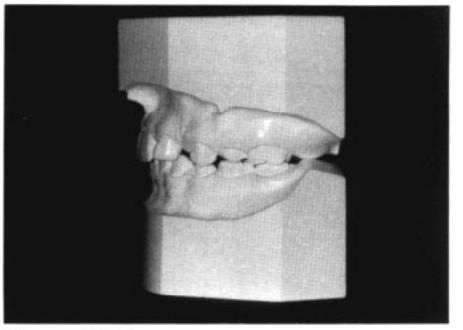

Figure 16C

Figure 16A-E
Dental development progresses at 12 years 6 months with Class II molar relationship on the left.

Figure 17
Progress radiograph at 12 years 6 months following the removal of several primary teeth and continued eruption. The position of the impacted canine has worsened.

Figure 18
Posttreatment panoramic radiograph following extraction of the maxillary left canine and substitution of the first premolar.

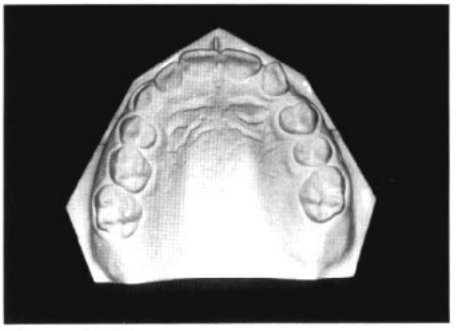

Figure 16D

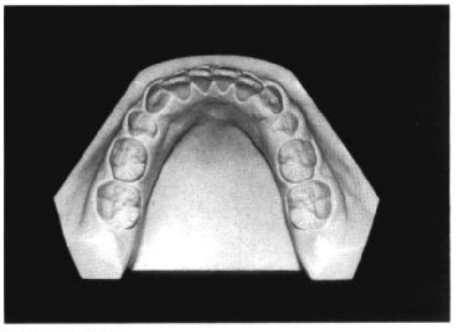

Figure 16E

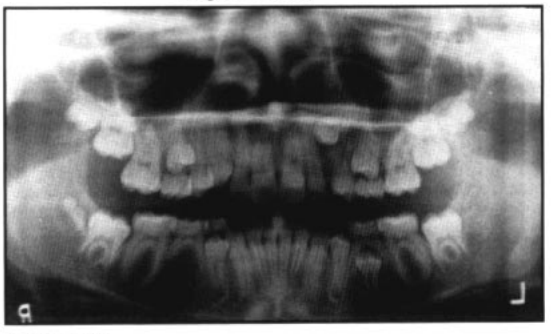

Figure 17

Figure 18

Results

Active treatment time was short, primarily because patience was exercised while waiting for the eruption of teeth. The decision to extract the displaced canine rather than to attempt to bring it into alignment was also a major factor.

During finishing, care was taken to rotate the maxillary left first premolar to the mesial for improved esthetics. It was also extruded slightly to improve function. Because the first molar on that side was slipped into a full Class II relationship, it was also rotated mesially to improve occlusal relationships. Surprisingly, the anterior/posterior relationship on the right side was less ideal due to retention of the mandibular primary second molar. This created a posterior tooth-size discrepancy and a lack of ideal cuspal interdigitation.

Bone levels appeared normal on the posttreatment radiographs. The roots of the retained primary molar showed no evidence of root resorption following the completion of treatment. All third molars were present but were slow to develop. Excellent mandibular growth was noted with much of it taking place prior to the placement of fixed appliances. Mandibular incisors were protruded slightly.

Maxillary and mandibular removable retainers were used full-time for the first several months following the completion of treatment. Retention concerns include preventing opening of the extraction space in the maxillary left quadrant and mandibular incisor crowding.

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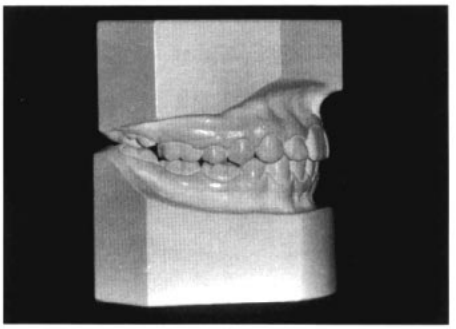

Figure 19A

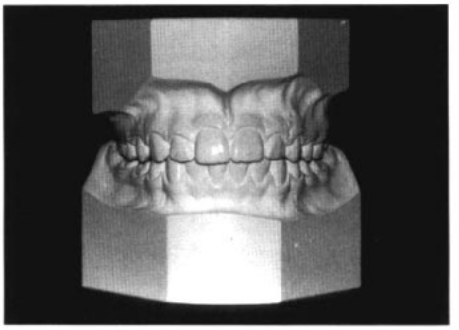

Figure 19B

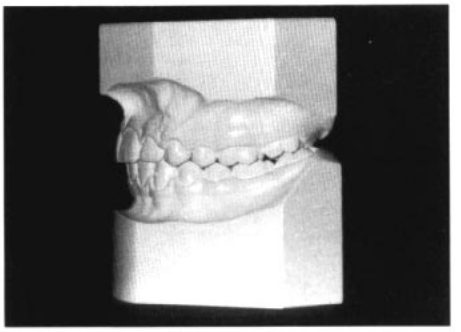

Figure 19C

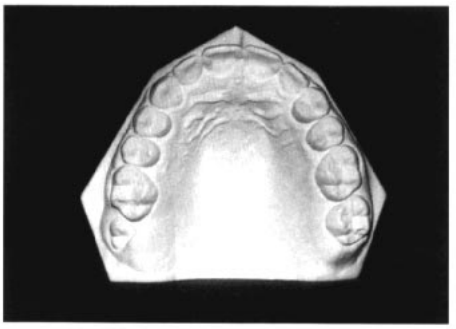

Figure 19D

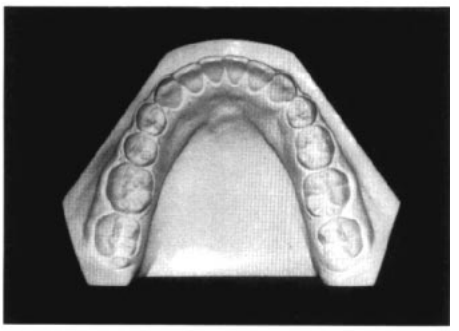

Figure 19E

Figure 19A-E
Posttreatment study casts. Note first premolar substitution for the previously ectopic canine and the retained mandibular primary second molar.

Figure 20A-B
Superimposed tracings at 10 years 5 months and 15 years 4 months. Note the excellent mandibular growth.

Figure 21A-B
Posttreatment facial photos at 15 years 4 months.

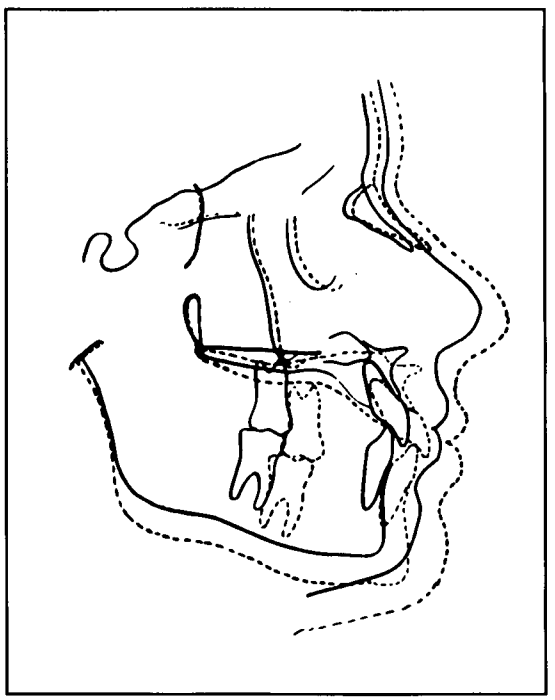

Figure 20A

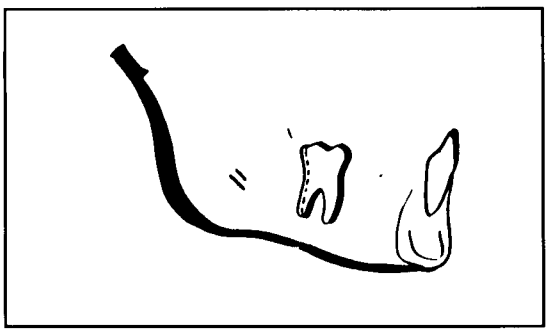

Figure 20B

Figure 21A

Figure 21B

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Discussion of both cases

A reflection on newly reported research findings will help answer the questions posed earlier in this paper.

According to Peck, et al.,[1] a number of dental anomalies are associated with the incidence of the palatally displaced canine. These range from differences in the number and/or size of teeth to the presence of ectopically positioned teeth, as seen in these cases.

The decision to treat Case JA with a nonextraction approach seemed appropriate due to the lack of crowding, but according to Woloshyn, et al.,[2] there are potential complications.Surgical exposure and orthodontic alignment of palatally impacted canines is associated with a loss of periodontal support mesial of the canine and distal of the adjacent lateral incisor, and with root resorption of the adjacent lateral incisor and premolar. Pulpal obliteration was found in more than 20% of the previously impacted canines. Retention after treatment is also a concern, as approximately 40% of the aligned canines were judged to be intruded, lingually displaced, mesially rotated, or discolored, when evaluated over 3 years after treatment.

In the future when looking for improved surgical techniques to aid in the alignment of displaced teeth, consideration should be given to closed eruption procedures. In their article (in this issue of *The Angle Orthodontist*) Vermette et al.[3] compared two groups of patients who were treated with different surgical techniques to expose unerupted anterior teeth. One group had an apically positioned flap (APF) procedure and the other group had undergone the closed eruption (CE) technique. The authors concluded that anterior teeth uncovered with the APF technique were less esthetic than those that were aligned with the closed eruption technique. The prospect for improved periodontal as well as esthetic benefits appears bright when this technique is used for displaced canines as well.

The decision to retain the mandibular primary second molar in Case EG was based on the excellent condition of the tooth and the expected retention problems until the patient was mature enough for a bridge or osseointegrated implant. Ostler and Kokich[4] investigated alveolar ridge width changes following the extraction of primary second molars in patients who were congenitally missing second premolars. They found that the alveolar ridge narrowed by 25% during the first 3 years. However, most of the ridge loss occurred on the buccal surface and, because the primary molars are wider than their successors, the final ridge width was similar to the control premolar dimension. Extraction of the primary molar would not necessarily jeopardize placement of an implant in that area. In this particular patient, extraction of the primary molar would also have improved posterior occlusion on the affected side.

The long-term stability of maxillary median diastema closure is an ongoing concern for any clinician. Both of these patients had maxillary diastemas prior to treatment. According to Sullivan, et al.,[5] measurable relapse in patients with relatively small midline diastemas (less than 1 mm) is less common than once thought. Space closure in more than two-thirds of the patients observed at least 10 years postretention was stable.

How will the studies referenced in this paper affect the treatment of displaced canines in the future? One could argue that patient JA could have been treated in much less time if a closed eruption (CE) surgical techniques[3] had been used. The second surgical procedure might have been avoided and more normal bone levels supporting the maxillary canines would have resulted. Ostler's study of alveolar ridge change[4] might have made extraction of the remaining primary second molar in patient EG more acceptable, and this would have created the opportunity for improved cuspal interdigitation on the right side.

These are only two examples of why every clinician must keep abreast of new findings in dental research. Our patients benefit greatly in direct response to the speed and accuracy with which we incorporate new findings into our practices.

References

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2. Woloshyn H, Artun J, Kennedy DB, Joondeph DR. Pulpal and periodontal reactions to orthodontic alignment of palatally impacted canines. Angle Orthod 1994; 64 (4) 257-264.
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